

Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-25 and 27-31 are pending in the application, with claims 1, 11, 12, 13, 14, 15, and 27 being the independent claims. Claim 26 is sought to be cancelled without prejudice to or disclaimer of the subject matter therein. Claims 1-4, 6-8, 11-15, 19, and 27 are amended to define the invention even more clearly. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Rejections under 35 U.S.C. § 102

Claims 1-4, 6-7, 9-15, 17-19, and 21-31 were rejected under 35 U.S.C. 102(b) as being allegedly anticipated by U.S. Pat. No. 5,541,026 to Matsumoto ("Matsumoto"). Applicants respectfully traverse.

Matsumoto is directed to a polarizing photomask and an apparatus containing such a polarizing photomask. Unpolarized light from an illumination system is incident on the photomask. The photomask then both polarizes and diffracts the illumination light. As discussed in Matsumoto, the photomask polarizes the illumination light according to TE polarization. TE polarization is effective for printing "line-and-space"

patterns (see col. 7, lines 39-44), as the directions of electric field vibration in TE polarization are orthogonal to each other. Additionally, Matsumoto mentions that an isolated hole pattern may be used as long as the isolated hole pattern is of "substantially square shape" (see col. 12, lines 32-37).

Once emitted from the polarizing photomask, the light in Matsumoto has a diffraction pattern. The "radial illumination mode" and "tangential illumination mode" cited in para. 2 of the Office Action refer to this diffraction pattern and its distribution within the plane, not to a particular polarization pattern of the light emitted.

In contrast, embodiments in the present invention include illumination light that is polarized and output on an optical path prior to being incident on a mask. The light may be polarized according to, for example, radial, tangential, or custom polarization. Because of this, the light is already polarized when it reaches the mask. Since the light need not be re-polarized after illuminating the mask, the light retains better definition of lines and features included on the mask. Additionally, the use of light other than pure TE-polarized light enables curved, 2-D features to be imaged, rather than restricting imaging to "line-and-space" images or an isolated feature having a substantially square shape, as referred to in Matsumoto. For instance, the polarization used to illuminate the mask in the present invention allows an array of substantially round contact holes having various pitches to be imaged and exposed onto a wafer. Such imaging and exposure of contact holes is not likely or possible if the light is pure TE light or if the light is not polarized prior to illumination of the mask.

Regarding claims 1, 11, 12, and 13, Matsumoto neither teaches nor suggests polarizing light according to a predetermined polarization pattern and outputting a

polarized exposure beam along an optical path to illuminate a mask, as featured in claims 1, 11, 12, and 13. As mentioned above, Matsumoto is directed toward a polarizing photomask, wherein polarization takes place within the photomask. For this reason, polarized light is not and needs not be incident on the photomask, and polarization within an illuminator is not discussed or suggested therein.

Regarding claims 2-4, in addition to the arguments discussed with respect to claim 1, Matsumoto neither teaches nor suggests radially, tangentially, or custom polarizing any part of the exposure beam. As discussed above, the sections referred to by the Examiner discuss attributes of the diffraction pattern and its distribution within a plane, but not the polarization pattern as now claimed.

Regarding claim 6, Applicants respectfully submit that, as discussed above with respect to claim 1, Matsumoto neither teaches nor suggests emitting pre-polarized light. The Examiner refers to col. 3, lines 1-10 and lines 36-49 as support for the rejection of claim 6. Applicants respectfully submit that the cited portion of Matsumoto does not discuss emitting polarized light to the photomask. Instead, this section states that the polarizing means is "arranged at the pupil plane," which is located immediately after the photomask, not before the photomask or in the illuminator. Further, the cited section states that the polarized pattern is formed on the substrate, but makes no mention of any polarization prior to the photomask. Therefore, this cited portion of Matsumoto does not teach or suggest emitting pre-polarized light from the illuminator.

Regarding claim 7, in addition to the arguments discussed with respect to claim 1, the only discussion in Matsumoto relating to contact holes involved an isolated hole, not multiple contact holes. Because of the limitations of the TE polarization used in

Matsumoto, multiple contact holes cannot be properly resolved with the high contrast in Matsumoto's invention. Therefore, Matsumoto neither teaches nor suggests illuminating a mask to produce an image that includes contact holes, as claimed in claim 7.

Claims 9-10 depend from claim 1, and are thus patentable over Matsumoto for at least the reasons discussed with respect to claim 1.

Regarding claim 14, as discussed above with respect to claim 1, the mask in Matsumoto is not illuminated by pre-polarized light, as claimed in claim 14.

Regarding claims 15 and 27, and as discussed with respect to claim 7, Matsumoto neither teaches nor suggests a mask including contact hole features having a pitch. As pitch is a measure of the distance between contact holes, and since Matsumoto states that the Matsumoto invention can only be used with non-"line-and-space" features if they are isolated, Applicants respectfully submit that Matsumoto does not teach or suggest use of masks including contact hole features having a pitch and indeed teaches away from using masks with contact hole features having a pitch.

Claims 17-19, 21, and 25 depend from claim 15, and are thus patentable over Matsumoto for at least the reasons discussed with respect to claim 15.

Regarding claims 22-24 and 29-31, in addition to the arguments discussed with respect to claims 15 and 27, Matsumoto neither teaches nor suggests using radial, tangential, or custom polarization. As discussed above, the sections referred to by the Examiner discuss attributes of the diffraction pattern in Matsumoto **not** a polarization pattern as set forth in the claimed invention.

Claim 26 has been cancelled due to redundancy, and thus its rejection has been rendered moot.

Claim 28 depends from claim 27, and is thus patentable over Matsumoto for at least the reasons discussed with respect to claim 27.

For at least these reasons, Applicants respectfully submit that claims 1-4, 6-7, 9-15, 17-19, 21-25 and 27-31 are patentable over Matsumoto. Reconsideration and withdrawal of the rejections of these claims is respectfully requested.

Rejections under 35 U.S.C. § 103

Claim 5 stands rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Matsumoto in view of U.S. Pat. Appln. Pub. No. 2002/0176166 to Schuster ("Schuster"). Applicants respectfully traverse. Claim 5 depends from claim 1, and is thus patentable over Matsumoto for at least the reasons discussed with respect to claim 1. Further, even if a combination of Matsumoto and Schuster is assumed for the sake of argument to be proper, Schuster fails to overcome the above-noted deficiencies of Matsumoto. Therefore, the combination of Matsumoto and Schuster neither teaches nor suggests every element of claim 5. For at least these reasons, Applicants respectfully submit that claim 5 is patentable over the combination of Matsumoto and Schuster. Reconsideration and withdrawal of the rejection of claim 5 is respectfully requested.

Claims 8 and 20 stand rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Matsumoto in view of U.S. Pat. No. 5,539,514 to Shishido et al. ("Shishido"). Applicants respectfully traverse. Claim 8 depends from claim 1, and is thus patentable over Matsumoto for at least the reasons discussed with respect to claim 1. Further, even if a combination of Matsumoto and Shishido is assumed for the sake of argument to be proper, Shishido fails to overcome the above-noted deficiencies of

Matsumoto. Therefore, the combination of Matsumoto and Shishido neither teaches nor suggests every element of claim 8. Similarly, claim 20 depends from claim 15, and is thus patentable over Matsumoto for at least the reasons discussed with respect to claim 15. Therefore, the combination of Matsumoto and Shishido neither teaches nor suggests every element of claim 20. For at least these reasons, Applicants respectfully submit that claims 8 and 20 are patentable over the combination of Matsumoto and Shishido. Reconsideration and withdrawal of the rejections of claims 8 and 20 are respectfully requested.

Claim 16 stands rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Matsumoto in view of U.S. Pat. No. 5,467,166 to Shiraishi ("Shiraishi"). Applicants respectfully traverse. Claim 16 depends from claim 15, and is thus patentable over Matsumoto for at least the reasons discussed with respect to claim 15. Further, even if a combination of Matsumoto and Shiraishi is assumed for the sake of argument to be proper, Shiraishi fails to overcome the above-noted deficiencies of Matsumoto. Therefore, the combination of Matsumoto and Shiraishi neither teaches nor suggests every element of claim 16. For at least these reasons, Applicants respectfully submit that claim 16 is patentable over the combination of Matsumoto and Shiraishi. Reconsideration and withdrawal of the rejection of claim 16 is respectfully requested.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be

withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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